A NEW SPECIES OF *SIROCLADIUM* (*S. CUTTACKENSE* SP. NOV.) FROM INDIA

– With notes on the Genus –

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ABSTRACT. – A new species of *Sirocladium (S. cuttackense* sp. nov.) has been described in the present paper. The species was found growing on shady soil on a garden near Cuttack (Orissa). This species differs from all the known species of the genus in having distinctly scrobiculate mesospote of the zygote. Distribution of all the known species has been given togethet with a key for their identification. *S. himalayense* Santra and Adhya has been considered here as conspecific with *S. maharashtrense* Randhawa. This is the first record of the genus from the state of Orissa.

RÉSUMÉ. – *Sirocladium cuttackense* n. sp., décrite dans cet article, a été récoltée sur le sol ombragé d'un jardin près de Cuttack (Orissa). Cette espèce diffère de toutes celles ptécédemment décrites par son zygote qui possède une mésospore distinctement scrobiculée. La distribution de toutes les espèces connues du genre *Sirocladium* est indiquée ainsi qu'une clé pour leur identification. *S. himalayense* Santra et Adhya est considérée comme conspé cifique de *S. maharashtrense* Randhawa: Le genre *Sirocladium* est décrit pour la première fois pour l'état de Orissa.

INTRODUCTION

The genus *Sirocladium* was established by RANDHAWA (1941) with the species *S. kumaoense* Randhawa, collected from Kumaon Hills, UP. Later on he added (1958 a, 1958 b) two more species : *S. maharashtrense* Randhawa and *S. vandalurense* Randhawa, the former from Maharashtra and the latter from Tamil Nadu. Subsequently all the three species wete recorded from few other states of India but none so fat from Otissa. SANTRA and ADHYA (1977) have tecently described a specimen of *Sirocladium* from Senchal Lake, Darjeeling (W.B.)

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and have claimed it to be a new species. RIETH (1975 a) has reported a new species (*S. cubense* Rieth) from Cuban soil which is the first ever recorded of the genus from outside Indian sub-continent.

While studying a recent collection of algae from Orissa the authors have come across this interesting genus. After investigations it was found to be an unrecorded species of *Sirocladium*. The species was found growing as dark green patches on shady soil (in a garden at Nischintakali (20°28' N and 86°11' E)) near Cuttack, India during the month of October, 1978. The alga was associated with a species of *Microcoleus*.

DESCRIPTION

Sirocladium cuttackense sp. nov. (Fig. 1-12)

Vegetative cells cylindric, 42.8-52.0μm x 112.0-120.0μm, cross wall plane; chloroplast 2 parietal ribbons with slightly irregular margins, (4)8-11.4(-13.2)μm broad; pyrenoids 6-8 arranged in a row; conjugation between two geniculate gametangia without formation of conjugation canal, mucilaginous pad present at the point of contact between the gametangia, receptive gametangia swollen; zygospore ellipsoid to globose, 52.0-82.5μm x (66.0-)76.0-102.3μm, yellowish brown to light orange; wall 3-4 layered; mesospore thick, scrobiculate with depressions of varying sizes and shapes.

Type locality : Nischintakali (Dt. Cuttack, Orissa) on garden soil in a shady place along with a *Microcoleus* species.

Holotype : No GM Temp. 1, October 26, 1978. Kept in the Algal Herbarium, Dept. of Botany, The University of Burdwan, West Bengal.

Sirocladium cuttackense sp. nov. (Fig. 1-12)

Cellulae vegetativae cylindricae, 42.8-52.0μm x 112.0-120.0μm, parietibus transversis planis; chloroplastus, taeniis duabus parietalibus cum marginibus parum irregularibus, (4-)8-11.4(-13.2)μm latus; pyrenoides 6-8, in una serie dispositae; conjugatio inter duo gametangia geniculata, sine canale conjugationis formato; mucus praesens ad punctum juncturae inter gametangia; gametangium receptivum tumidum; zygospora ellipsoidea ad globosa, 52.0-82.5μm x (66.0-) 76.0-102.3μm, flavo-brunnea ad dilute aurantiaca, parieta 3-4-strato; mesospora crassa, scrobiculata cum depressionibus formarum-amplitudinumque variantibus.

Holotypus lectus ad locum Nischintakali Dt. Cuttack, Orissa, die 26 Octobri, 1978, et positus in herbario algarum in sectio Botanica, Universitatis Burdwanensis, Benghala Occ. (sub numero GM Temp. 1).

TAXONOMIC CONSIDERATIONS

RANDHAWA (1941) based his genus (*Sirocladium*) mainly on the number (always two) and nature of chloroplast (broad plate-like with smooth or laciniate

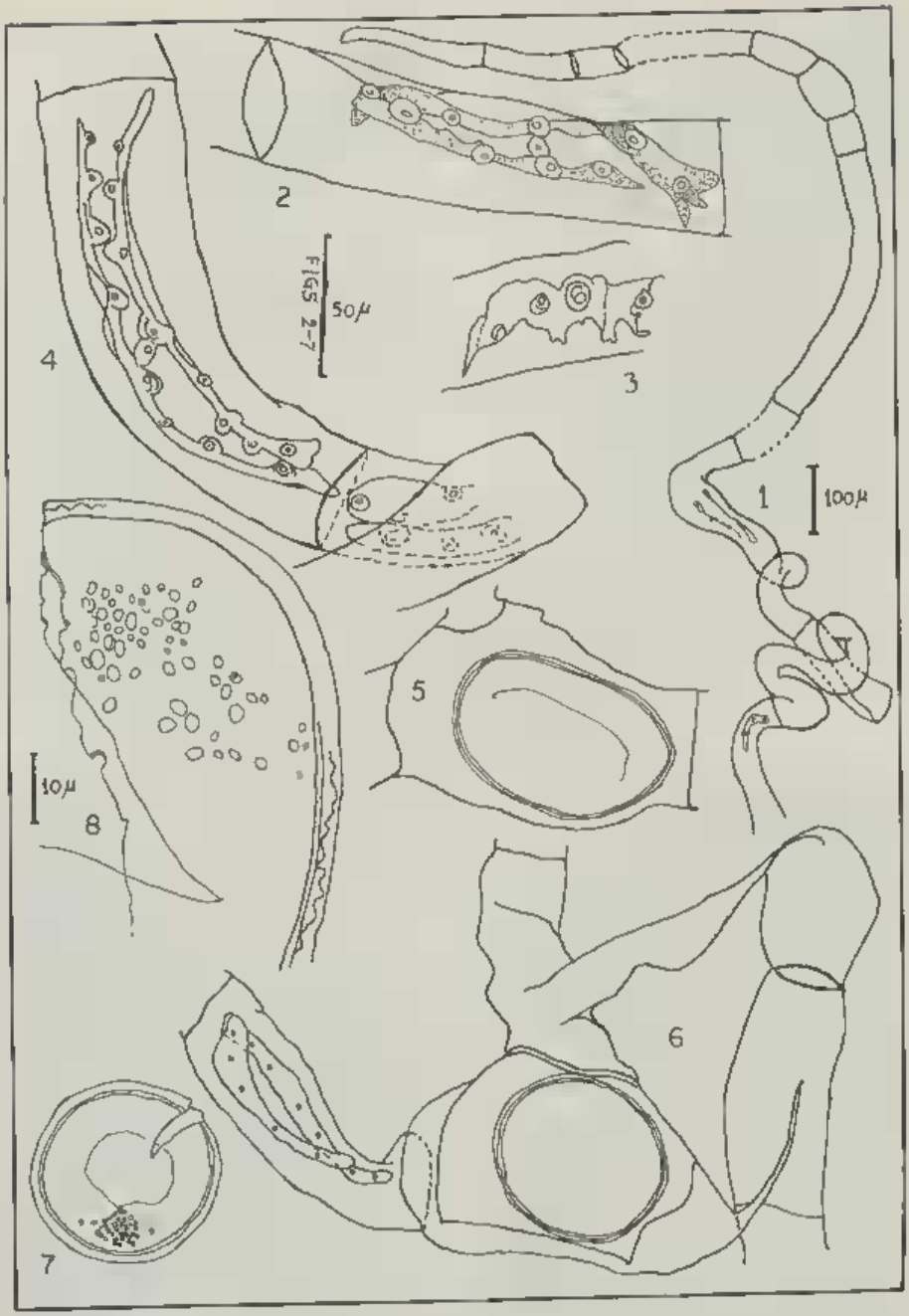


Plate 1. — Fig. 1-8 : *Sirocladium cuttackense* sp. nov. — Fig. 1 : A filament showing coiling; tapering of filament end into rhozoid; gamctangium with short cell. Fig. 2-4 : Cells showing chloroplasts and pyrenoids; note laciniate characters in fig. 3. Fig. 5 : A zygospore within female gametangium. Fig. 6 : Geniculate conjugation. Fig. 7 : A zygospore. Fig. 8 : Details of zygospore wall showing scrobiculate ornamentation of mesospore.

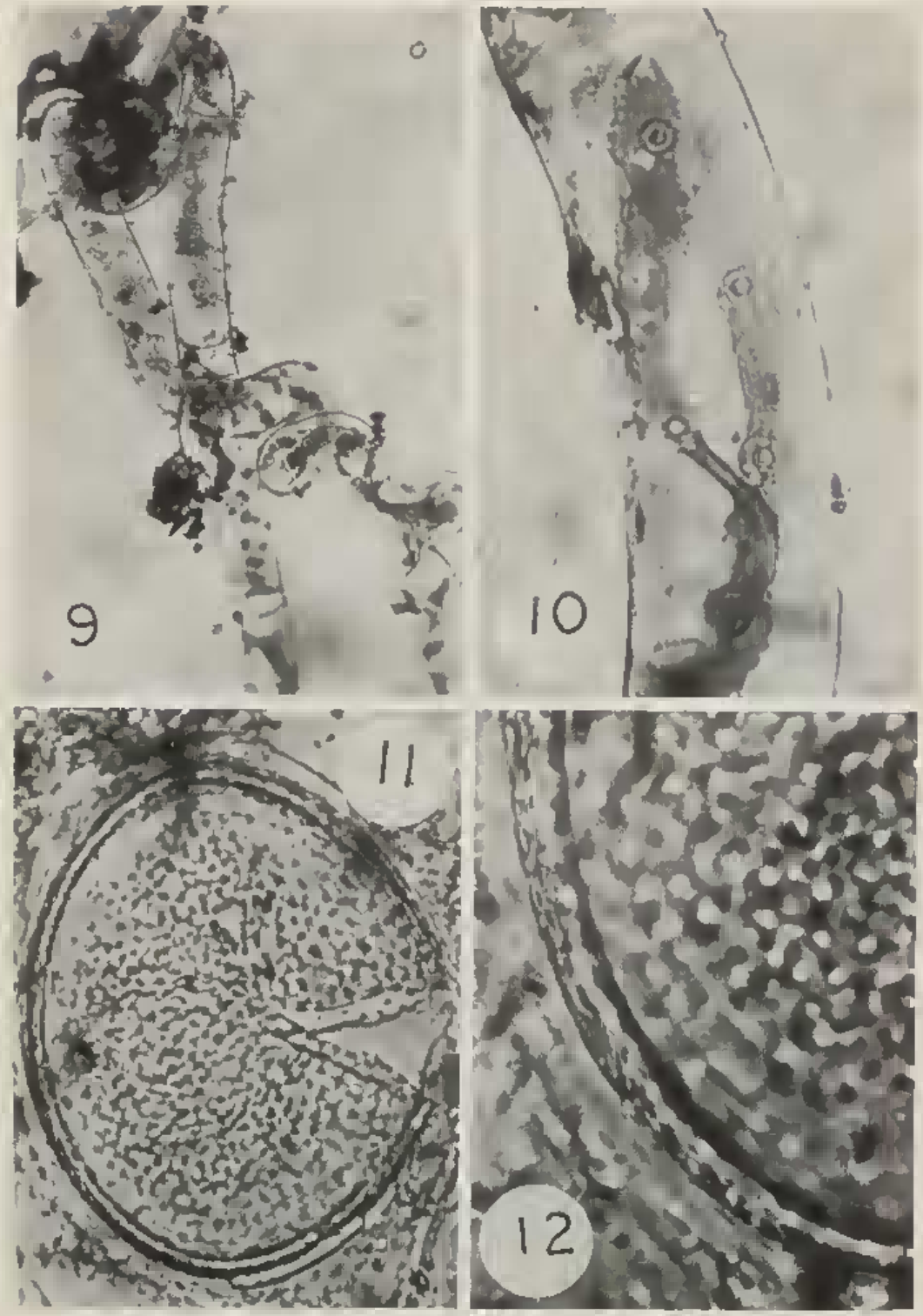


Plate II. Fig. 9-12 : *Sirocladium cuttackense* sp. nov. — Fig. 9 : Vegetative filament showing coiling (x 170). Fig. 10 : Cell showing chloroplasts and arrangement of pyrenoids. (x 700). Fig. 11 : Zygospore wall showing scrobiculation (x 700). Fig. 12 : A magnified portion of zygospore wall showing scrobiculation (x 1680).

margins or long ribbon-like parietal), method of reproduction (by geniculation or loop formation without forming conjugation canal), occasional production of rhizoids and its terrestrial habit. The erection of a new genus on the basis of above characters was questioned by SINGH (1945). CHOWDARY (1968) expressed similar views while investigating on *S. vandalurense* (?) Randhawa (collected from an aquatic habitat with occasional presence of more than two chloroplasts and absence of rhizoids when in soil with high moisture content). SINHA and NOOR (1969-70) on the basis of their observations on *S. kumaoense* collected from Ranchi (growing on moist alluvial soil under shade of a mango tree) have gone to the extent of merging the genus *Sirocladium* with *Sirogonium*. But the occurence of the genus in places where there is little chance of inundation such as in Almora (RANDHAWA, 1959), Rumaon Hills (RANDHAWA, 1941), Nainital (SINGH, 1959 a, 1959 b, 1959 c), speaks of its terrestrial nature. Reports from aquatic habitats (CHOWDARY, 1968; SANTRA and ADHYA, 1977) merely indicate that the genus is also capable of growing in water. The nature of chloroplast (which appears different in different views) is the considerable significance and similar type is unknown in the genus *Sirogonium*. Also the pyrenoids in all the known species are very prominent. Beside CHOWDARY's (1968) report of chromosome number in a specimen of *Sirocladium*, there is no cytological information available as yet to provide any clue in settling the controversy regarding the status of *Sirocladium*.

SANTRA and ADHYA (1977) have recently described a new species of *Sirocladium (S. himalayense)* from Senchal lake, Darjeeling which seems to be identical wiith *S. maharashtrense* Randhawa. This species was distinguished from *S. maharashtrense* Randhawa on the basis of so called differences in size of the vegetative cells, shape of the chloroplasts and the zygotes. In fact, the chloroplasts in both the species are more or less straight and pyrenoids are arranged in a row. Both have globose ellipsoid yellow brown zygospore with reticulate mesospore. The size of zygospores, vegetative cells and the chloroplasts in both the species are also within the comparable range.

The chloroplast characters may vary within the same species depending upon the habitat. ISLAM (1965) found, in addition to the usual straight and entire chloroplast, wavy and finely laciniate margins of the chloroplasts of *S. kumaoense* Randhawa kept in shady place. It is evident from the above discussion that *S. himalayense* Santra and Adhya and *S. maharashtrense* Randhawa are in fact one and the same, and the former is considered here as conspecific with the latter.

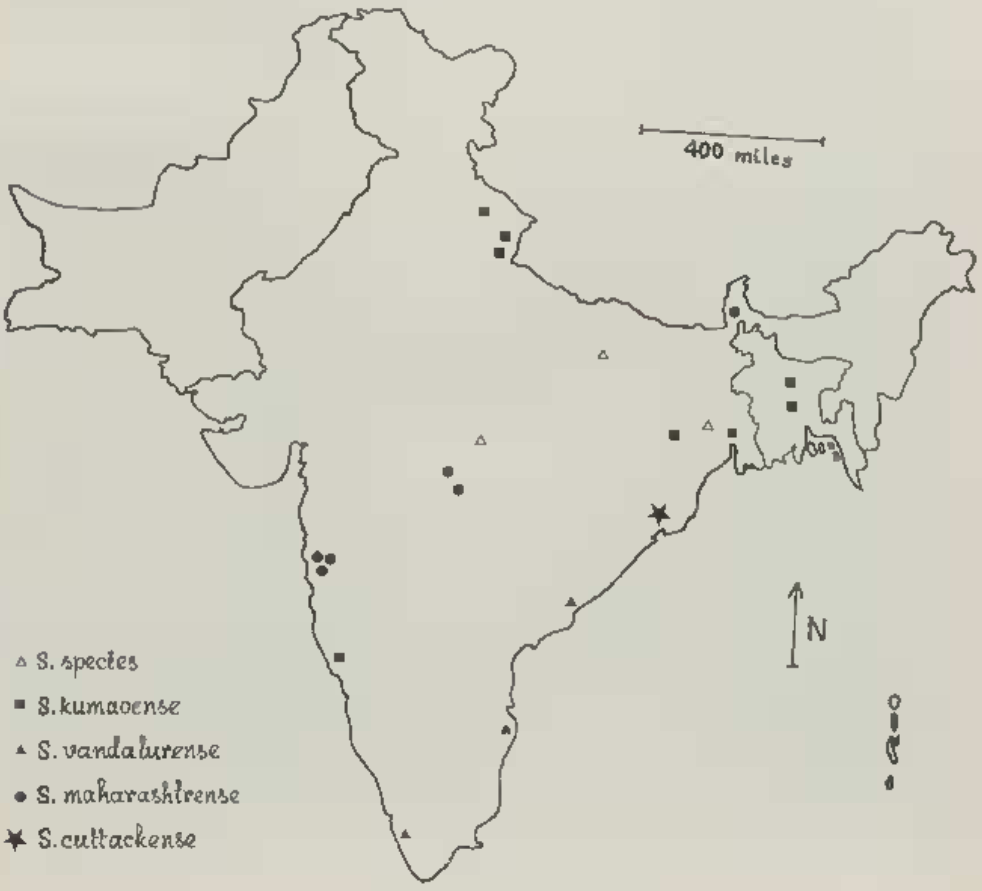
Amongst species with ornamented zygospore wall, *S. maharashtrense* Randhawa (RANDHAWA, 1958 a) and *S. vandalurense* Randhawa (KODHARI, 1967) show reticulate type, *S. cubense* Rieth (RIETH, 1975 a) punctate type and the present species scrobiculate type of mesospore. CHOWDARY (1968), however, mentioned smooth wall for *S. vandalurense* Randhawa and it is probable that his identification was not correct. The present species shows superficial resemblance with *S. maharashtrense* Randhawa in its shape and size of the chloroplast and the zygote but differs from the same and all the other species of the genus in having scrobiculate mesospore.

KEY TO THE KNOWN SPECIES OF *SIROCLADIUM*

1. Zygospore wall smooth . . . . . *S. kumaoense*
1. Zygospore wall ornamented 2
   2. Mesospore reticulate 3
   2. Mesospore otherwise 4
3. Chloroplast margin more or less straight, pyrenoids in a row . . . . . *S. maharashtrense*
3. Chloroplast margin laciniate, pyrenoids scattered . . . . . *S. vandalurense*
   4. Mesospore finely punctate . . . . . *S. cubense*
   4. Mesospore distinctly scrobiculate . . . . . *S. cuttackense* sp. nov.

DISTRIBUTION OF *SIROCLADIUM*

Different species of *Sirocladium* have been reported from the following places (see Map I for distribution in Indian subcontinent) :



Map I : Distribution of known spp. of *Sirocladium* in Indian subcontinent.

S. kumaoense **Randhawa 1941**

India : Kumaon Himalayas, U.P. (RANDHAWA, 1941); Calcutta, West Bengal (RANDHAWA, 1958a); Almora and Gananath, U.P. (RANDHAWA, 1959); Nainital, U.P. (SINGH, 1959a, 1959b, 1959c); Kolhapur, Maharashtra (KAMAT, 1963); Ranchi, Bihar (SINHA and NOOR, 1969-70 as *Sirogonium strictum* (Engl. Bot.) Kütz. var. *terrestris* Sinha and Noor); Dehra Dun, U.P. (KHAN, 1970; KHAN and USHA, 1971).

Bangladesh : Dacca and Mymensingh (ISLAM, 1965).

S. maharashtrense **Randhawa 1958 a**

India : Khandala and Karjat, Western Ghats, Maharashtra (RANDHAWA, 1958a); Bhopal and Panchmundi, M.P. (AGARKAR and AGARKAR, 1972); Darjeeling, W.B. (SANTRA and ADHYA, 1977 as *S. himalayense* Santra and Adhya).

S. vandalurense **Randhawa 1958 b**

India : Vandalur near Madras, Tamil Nadu (RANDHAWA, 1958 b); Mundakkal near Quilon, Kerala (KODHARY, 1967); Kankinada, A.P. (LAKSHMINARAYAN, 1978).

S. cubense **Rieth 1975 a**

Cuba : Province Oriente, Cuba (RIETH, 1975 a, 1975 b).

S. cuttackense **sp. nov.**

India : Nischintakali (near Cuttack), Orissa.

CHOWDARY (1968) has also reported a specimen under the name *S. vandalurense* from Banaras, U.P. which actually does not agree with the description of the mature specimen given by KODHARI (1967). Recently sterile specimens of *Sirocladium* have been recorded from Nagpur, M.P. (TARAR and CHERIAN, 1979) and also from Burdwan, W.B. by the present authors (unpublished). The disjunctive distribution of the genus (in Indian subcontinent and Cuba) strongly suggests the need for its further search in the tropical belt.

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